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THIRD ALL-UNION CONFERENCE ON
RADIO ELECTRONICS

- USSR -

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THIRD ALL-UNION CONFERENCE ON RADIO ELECTRONICS

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The third All-Union Conference on Radio Electronics of the Ministry of Higher Education USSR, devoted to the memory of A. S. Popov was held from 22 through 27 January 1959 at Kiev. About 500 delegates of institutions of higher learning and various scientific industrial establishments of the Academy of Sciences USSR, and Academy of Sciences Ukrainian SSR, took part in the Conference.

The following sections worked at the Conference: Ultrahigh Frequency Electrophysics, Ultrahigh Frequency Electronics, General Electronics, Quantum Radio Engineering and Radio Spectroscopy, Radio Wave Propagation and Radio Astronomy, Semiconductors and their Application in Radio Equipment, and General Radio Engineering.

The following survey reports were read at the plenary sessions: V. K. Tkach "Certain Results of the Application of Radio Electronics to the Study of Biological Media," V. I. Siforov "Problem of Channels of Communication with Random Changes of Parameters," I. A. Kukurite, G. I. Rukman, O. Ya. Savchenko, M. K. Safronova, G. M. Khaplanov "Prospects of the Use of Certain Optico-Radiophysical Phenomena for the Creation of New Ultrahigh-Frequency Devices."

In the decision taken by the Conference, there are a number of recommendations relating to the trend of scientific research work at higher education institutions and scientific research institutes, as well as certain suggestions of an organizational character. It was proposed that the next, Fourth Conference of the Ministry of Higher Education on Radio Engineering and Electronics, be held in November 1960 at Khar'kov.

The Work of Conference Sections

Radio Wave Propagation and Radio Astronomy Section

The evening session of 24 January opened with a report by V. V. Zheleznyakov, entitled "On Magnetic Retarding Radiation and Unsteadiness of the System of Charged Particles in Plasma." The report gives the results of the evaluation of the magnetic retarding radiation of the unbalanced electronic system obtained on the basis of the quantum theory on radiation and absorption of electromagnetic

waves. The criteria of amplification and unsteadiness of electromagnetic waves at the frequencies of magnetic retarding radiation within the system of magnetoactive plasma and the flow of charged particles were formulated.

The paper read by B. N. Gershman entitled "On the Theory of the Propagation of Low Frequency Waves in Magnetoactive Plasma" was devoted to the problems of the propagation of electromagnetic waves with frequencies $\omega < \omega_0, \omega_H$ where ω_0 is the plasma frequency and ω_H is the gyro frequency of the electrons. In this case the index of waves refraction is far greater than one, i.e., the wave is slow. The attenuation of these waves due to the thermal movement of particles (Landau mechanism) was estimated. The results obtained were utilized in the theory of "whistling atmospherics."

B. S. Shapiro in his report on "Investigation of the Distribution of Ionization with Altitude by the Method of Vertical Radiosondage of the Ionosphere" gave an account of the method devised by him of determining geometrical parameters of ionospheric strata (altitude, half-thickness, etc.) according to the tabulated ionospheric data. As a result, it appeared to be possible to study variations of geometrical parameters of the ionosphere on the basis of vast material provided by observations of the ionosphere, in conformance with the program of the International Geophysical Year.

V. D. Gusev, S. R. Mirkoman, L. A. Drachev, Yu. V. Berezin and M. P. Kiyanovskiy read a paper on "Results of the Investigation of Parameters of Large-Scale Heterogeneities of the Ionosphere by the Phase Method." The experiments were conducted from January 1957 through May 1958. The method used was that of three space-diversity antennas with base 30 to 40 km, through which the variations of the phase path of reflection of ionospheric signals were measured. It was established that large-scale heterogeneities have an elongated form with a ratio of semiaxes 1.5 to 2.0. The dimensions of heterogeneities along the major axis are of the order of several hundred kilometers and the velocity of their drift is 130 to 170 m sec⁻¹.

The second communication by the same authors, "On the Correlative Treatment of Fluctuations in the Presence of a Slowly Changing Nonstationary Component" was, in fact, a continuation of the preceding report. In this, the possibilities of exclusion of a slow daily course of the phase path in correlative treatment of the data on fluctuations of the reflection of signals by the ionosphere were discussed, and the influence of this factor on the precision of the measurements was evaluated.

The communication of Ye. A. Benediktov and N. A. Mityakov on "Evaluation of the Influence of the Earth's Magnetic Field in the Study of Ionospheric Heterogeneities," set forth the results of calculation of the intensity of the signal dispersed by ionospheric heterogeneities in the approximation of quasi-longitudinal propagation of the wave in relation to the magnetic field. Comparison of the results of evaluation with published data on the vertical sondage of the ionosphere gives, for the relative deflection of the concentration of the particles in the heterogeneities, the value of $\Delta N/N \sim 4 \cdot 10^{-4}$.

At the morning session of 26 January, M. M. Kobrin read a communication on "Radio Echo from the moon on 3 and 10 cm Waves." He spoke on the results of the investigation of radio signals reflected by the moon, which were sent by a transmitter of continuous action and received by means of a radio-astronomical receiver of high sensitivity. It was found that the reflection from the moon of $\lambda = 3$ cm and $\lambda = 10$ cm has a mirror character and is mainly determined by the central part of the moon disc.

The communication entitled "On Nonthermal Cosmic Radio Emission" was contributed by G. G. Getmantsev. In this, an attempt was made to explain the radio emission of the plane component of cosmic radio emission on the basis of the ideas on the magnetoh-retarding origin of radio emission.

V. A. Razin read the communication on "Observation of the Ring-Shaped Solar Eclipse of 19 April 1958 on Waves of 1.63 cm, 3.2 cm and 10 cm" on behalf of the group - Du Len-Yao, A. N. Malakhov, V. M. Plechkov, V. A. Razin, V. L. Rakhlin, K. M. Strezhneva, K. S. Stankevich, Tan Shou-Pe, V. S. Troitskiy, V. V. Khrulev and N. M. Tseytlin. The eclipse was observed on the island of Hainan in China. From curves of the change of intensity of radio emission during the eclipse, it was possible to determine the distribution of radio brightness on the solar disc on the day of the eclipse, to evaluate the effective temperature of the active radio emitting regions and to measure the integral flow of radio emission.

In the communication of V. L. Ginzburg and V. Ya. Eydman, "On Certain Peculiarities of the Emission of Electromagnetic Waves by Particles Moving with Faster-than-Light Speed in a Medium," the peculiarities of the emission of electromagnetic waves by "faster-than-light" particles were discussed. The classical calculation of the force of radiation friction during movement of the charged particle in a magnetic field showed that with "faster-than-light" speeds the force of the emission reaction altering the rotation radius of the particle decreases as compared with the case of movement "up-to-the-speed-of-light" and, in an anisotropic medium, it can even change the sign, that is, correspond not to the "friction" but to the drive of the oscillations.

A. A. Semenov and G. A. Karpeyev spoke on "The Connection of the Frequency of Fluctuations of the Field Amplitude with the Speed of the Drift of Heterogeneities." They quoted the results of the evaluation and experiment in the determination of the frequency of fluctuations of the reflected radar signals in the centimeter band. The connection between the frequency of fluctuations and the speed of movement of the heterogeneities was established.

The morning session of 26 January ended with a lecture by G. Ye. Brengauz, "On the Possibilities of Detection of Monochromatic Lines of Absorption in the Spectrum of Radio Emission of the Sun." The speaker quoted the results of evaluations of the intensity of radio lines of hydrogen and singly-ionized helium in the spectrum of

solar radio emission.

At the evening session of 26 January, four papers were read.

The communication of I. D. Gits, B. A. Ioshy and E. I. Mogilevskiy on "Electronics of Solar NIZMIR Magnetographs" contained a description of the circuits of a radio electronic meter separating the signal with the frequency magnetographs.

In the next communication entitled "Electro-Optic Light Modulators of the NIZMIR Magnetograph," I. A. Zhulin gave a description of an electronic light modulator based on the use of the Kerr cell.

In the communication "On the Statistical Properties of the Intensity of the Field of Atmospheric Radio Noise," Ya. I. Likhter and G. I. Girina quoted experimental data on the distribution of the probability of the envelope of the field of radio noise.

V. Ye. Kashprovskiy, in the communication on "A New Method of Measuring the Conductivity of Soils according to the Attenuation of Waves and Results of Measurements," proposed to utilize for the determination of the conductivity of soils at the frequencies of the broadcasting bands, the measurement of the depth of penetration of the field into soil, using for this wells, boreholes, etc. The experimental checkup of the method showed its effectiveness.

Section of Ultrahigh Frequency Electrodynamics

At the sessions of the Section of Ultrahigh Frequency Electrodynamics, 30 papers and communications were read, which were devoted to the theoretical and experimental investigation of retarding systems, waveguide structures and transmission lines, coordination of ultrahigh frequency structures, study of cavity resonators, as well as problems of the measurement of ultrahigh frequencies.

The reports of Yu. G. Al'tshuler (theoretical analysis of counter-pin systems), B. M. Bulgakov (exact and approximate estimates of spirals with magneto-dielectrics), I. G. Gladyshev (investigation of diaphragm-type waveguides with additional coupling elements in the form of π -shaped slots, inductive loops and capacitive pins), V. N. Ivanov (study of properties of stacked pin connecting strips) were devoted to treatment of the theory and experimental studies of retarding systems. Likewise devoted were two reports of N. M. Chirkin, one of them to a study of the dispersion properties of coaxial systems in which both conductors are loaded with discs, the other to an investigation of a coaxial system with a spiral chute on the inside conductor. The report of A. S. Bondarev and G. F. Semenov set forth an investigation of the dispersion properties of spirals with dielectric mounts achieved by means of a sonde with high-ohmic supply. V. D. Ivanov and V. S. Mikhalevskiy reported on the findings of an investigation of a retarding system of the spiral type in the presence of plasma. Systems representing a combination of spiral and ribbed structure (spiral in ribbed waveguide and ribbed rod in spiral) were studied by V. A. Slyusarskiy. Under certain

conditions such systems are analogous to a combination of spiral and anisotropic dielectric.

Z. I. Taranenko investigated a wave-like bent waveguide of rectangular cross section with openings for passing the electron beam. He established that when the transit channel is made in the form of alternating openings of two different dimensions, the dispersion of such a retarding system becomes positive in the longwave range of the pass band.

A. G. Sveshnikov made an interesting report on evaluating a bent waveguide of variable cross section. In this paper general equations of the electromagnetic field were given, approximate solution methods in case of slowly varying waveguide characteristics were examined and methods of calculating by means of highspeed computers were discussed. V. S. Il'in extended to four-pole symmetrical systems the Levin-Shvinger variation method for calculating sudden nonuniformities in rectangular waveguides. In another paper V. S. Il'in reported on a method of computing waveguide nonuniformities by means of an equivalent resonator. The calculation was made with use of the variation method and illustrated in concrete examples (dielectric rods of different forms, bearing washers in coaxial cables, and others.).

In V. M. Sedykh's paper the constant attenuation of H-waveguides was determined and it was demonstrated that in such waveguides the attenuation is less than it should be from the Cohn theory. The dependence of the constant attenuation of a cross-shaped waveguide on the oscillation frequency and dimensions of the waveguide cross section were determined in the paper of V. M. Sedykh and A. F. Zorkin.

V. V. Tyazhelov set forth an approximation method of computing the effect of nonuniformities on single-wire lines, that is similar to the problem-solving method with diffusion of a plane wave on a sphere.

V. P. Sazanov and Ye. V. Skazochkin devoted their paper to problems of balancing a coaxial-spiral crossing by means of a multi-sectional transformer formed from segments of spiral with distribution of their wave resistances according to Chebyshev. Experimental investigations demonstrated that such crossings designed according to a developed method, can secure balancing in the range of three and more octaves with KSVN [probably coaxial-spiral wave norm] less than 1.5. Ya. M. Turover studied the balancing of a coaxial line with a rectangular waveguide by means of a conic antenna with a small angle of aperture. G. I. Shmel'kova determined on the basis of the variation method, the parameters of the equivalent circuit of a slot power lead from a toroidal resonator.

Spatial overtones in cavity resonators, and also a new type of resonance depending on the driver position and partially on the ratio of sides in a rectangular resonator and called "wandering," were studied in the work of B. P. Petrov. Distortions of the electromagnetic field configuration in a cavity resonator with non-

ideal walls was evaluated in the paper of A. S. Bondarev.

A. I. Fursayev examined the dispersion of a resonator system with double ties.

The paper of Ye. D. Mayboroda gave the theoretical grounds of a method for determining the full resistance of a point-contact diode (semiconductor) at super-high frequency in small signals conditions according to the rectified current's dependence on the position of a short-circuiting plunger situated beyond the diode. The measurement of the full input resistance of a detector according to the rectified current's dependence on the position of a short-circuiting plunger situated beyond the detector was the subject of the report of R. N. Dondarenko, Ye. D. Mayboroda and V. I. Strikh. This method can be employed in the case when measurement by means of a measuring line becomes difficult or impossible. For raising the sensitivity of ponderomotor measurers of power, V. D. Kukysh proposed that the circuit of a structure with travelling wave be used. Examined in the paper of K. P. Yatsuk was the possibility of measuring the dielectric permeability of solid and liquid dielectrics when they are placed inside a spiral retarding system.

Super-High Frequency Electronics Section

The reports and communications of the super-high frequency electronics section were devoted to the problem of studying the new methods of generation and amplification, and also problems of making theory more precise, raising the efficiency and improving the parameters of tubes operating on known principles.

The papers were in considerable number devoted to phasochronic generators based on effective multiple energy exchange between the electron flow and the electromagnetic field with velocity parity of the flux of charged particles and the wave phase. The work of K. Ya. Lidzhvoye performed an experimental investigation of a phasochronic generator with cross interactions in which the electrons travel in crossed electrical and magnetic fields along a non-retarding system over roughly trochoidal trajectories. The experimental study of another phasochronic generator was done in the work of Z. I. Taranenko. A Phasochronic generator with combined interaction employing a retarding system was examined in the paper of I. V. Akalovskiy. In a generator of this type the electrons interact both with the cross and the longitudinal components of the high frequency field, which makes it possible, with less magnetic fields, to get shorter wave lengths than in generators without a retarding system.

The interaction of a trochoidal beam with the electromagnetic wave in waveguides was examined in the report of A. V. Gaponov. It was demonstrated that amplification of high frequency oscillations in such systems is possible only in case the velocity of the electron drift exceeds the wave's phase velocity, i.e. only in the case when the interaction of the electromagnetic wave is accomplished with one

of the "slow" harmonics of the beam current. The interaction of a trochoidal beam of electrons with a non-retarded wave under the conditions of the takeoff of unfavorably phased electrons was studied in the paper of V. M. Bokov. The basic properties of this type trochoidal amplifier were described and an evaluation was made of the maximal efficiency at high levels of power. An experimental investigation of a trochotron amplifier in the three-centimeter range was made by I. I. Antakov and R. P. Vasil'yev. It was established that amplification occurred in those conditions when the electrons having taken energy from the high-frequency field settled on one of the tube electrodes. In the authors' opinion, the trochotron amplifier can be used in the capacity of an adjustable amplifier of average power.

In the investigation of focusing beams of charged particles with high-frequency fields, D. M. Bravo-Zhivotovskiy, B. G. Yeremin, Ye. V. Zagradskiy, M. A. Miller and S. B. Mochenev obtained interesting experimental findings.

The excitation of waveguides and retarding systems with modulated linear flows of charged particles travelling with variable velocity was examined in the work of V. A. Ginzburg, V. A. Solntsev and A. S. Tager. It was demonstrated that for the flow of a finite line the intensity of radiation depends on the ratio between the average velocity of particles and the group velocity of the waves in the waveguide, and for an infinitely long flow the ratio between these velocities is immaterial. The interaction of electromagnetic waves with electron fluxes of variable velocity was studied also by V. A. Sosunov, who derived an expression for the generated power, frequency and efficiency of the electronics.

The paper of V. M. Lopukhin, B. D. Charkin and N. G. Zeveke cited the findings of an experimental investigation of the parametric amplification in LOV [possibly a wave deflection tube] with two dual-approach spirals in series. The first cascade operated as a generator of feed and the second was used as a signal amplifier. The findings of an experimental investigation of parametric amplification in a travelling-wave tube with two spirals in series were reported also by D. A. Akulina, S. A. Akhmanov, A. S. Gorshkov and I. T. Trofimenko. In this case the feed signal from the outside generator was introduced in the travelling-wave tube's first spiral, and the amplified signal in the second.

At section sessions the paper of V. G. Karamzin about development of a continuous action amplifier klystron with output power of 10 kwts was read and also the report of Ya. Ya. Akmentynykh, S. A. Zusmanovskiy and Z. I. Khaplanova about a new approach to calculation of bunchings in powerful straight-transit klystrons. For the case of small amplitudes, simple expressions have been derived for the induced current giving good concurrence with results of the theory of Kahn and Ramo [Rameau?]. In the case of large amplitudes the continuous electron flux is represented as comprising charged

discs and rings, the travel of which is also investigated. The problem of bunching at large amplitudes is solved on a computer.

Presented in the paper of S. D. Gvozdover and G. G. Solodov were the findings of elaboration of the travelling-wave tube theory for medium currents; it was shown that in case of medium currents the factor of amplification is found to be less, while the factor of depression is more than the weak current theory gives. The papers of A. M. Kats, and also of A. M. Kats and M. B. Tseytlin were devoted to elaboration and making the travelling-wave tube theory more precise.

Yu. L. Klimontovich reported on the results of an analysis of non-linear oscillations that arise in the plasma during the passage of a beam of electrons through it. The author's original treatment of the mechanism of exciting these oscillations aroused a discussion.

The paper of D. M. Petrov was devoted to problems of engineering nomographic calculation of a reflex klystron. The stabilization of a reflex klystron's frequency by means of an outside cavity resonator was studied in the work of Yu. N. Kuznetsov. V. A. Malyshev reported on the findings of an experimental verification of the theory of super-high frequency generators with complex oscillating systems.

Examined in the paper of I. R. Gekker was the possibility of raising the efficiency of transit klystrons, traveling wave tubes and other super-high frequency devices by means of multi-cascade retarding of electrons in a sectionalized collector. G. N. Rapoport devoted his report to the problem of raising the efficiency of LOV by means of a sudden or gradual reduction of couplings of the initial section of a retarding system with an electron beam. Great interest was aroused by the report of V. S. Yergakov and A. A. Shaposhnikov about a two-span klystron with cross control in which cross modulation of the electron beam by the super-high frequency field is accomplished in the first resonator and the amplified signal is taken from the second resonator. It was demonstrated that in a klystron of such type amplification of the order of 25 db with a noise factor of 3 to 5 db is achievable.

At the section's concluding session a discussion was held devoted to an evaluation of the possibilities of the preset field method in analysis of the interaction of an electron beam with electromagnetic waves. S. D. Gvozdover, V. M. Lopukhin, V. N. Shevchik, A. S. Tager, M. B. Goland and S. I. Averkov participated in the discussion.

Quantum Radio Engineering and Radio-Spectroscopy Section

At the section's morning session on 25 January data on the installation, operating principle and technical possibilities of atomic-radiation standards of frequency were given in the survey report of I. A. Kalyabina, V. P. Laguzov, G. I. Rukman and Ya. A. Yuhvidin, entitled "Modern Atomic-radiation Means of Stabilizing Super-High Frequency."

In the report of V. M. Fayn, entitled "Theory of Coherent

Spontaneous Radiation," certain questions were examined about the theory of coherent spontaneous radiation in the radio range. It was demonstrated that interaction through the general field of radiation leads to a shift of the system's natural frequencies. The paper of G. L. Suchkin devoted to the theory of a parametric mixer in ferrites was read at the same session.

At the evening session of 23 January the paper of Ya. N. Shamfarov, entitled "A Highly-Sensitive Paramagnetic Spectrometer at Frequency of 9,000 Mc," described a paramagnetic radio-spectrometer with stabilization of the spiral klystron frequency by a measuring resonator and an automatic frequency control heterodyne. With the receiving channel band 25 kc, the experimentally verified sensitivity amounted to $5 \cdot 10^{-9}$ moles of diphenyltrinitrophenylhydrosil. The paper of I. A. Deryugin and M. A. Sigal was devoted to an investigation of the dispersion properties of isotropic artificial dielectrics in the 500 to 25,000 Mc range. Cited in the report were the results of measurements of magnetic and dielectrical permeability of copper-paraffin mixtures depending on the concentrations of the conducting particles. The findings of the measurements are in good accord with theory. The dispersion of dielectric permeability was detected at frequencies in which the skin-layer becomes less than the particle dimensions.

The report of V. S. Etkin and Z. M. Gershenzon, entitled "Parametric Regeneration in the Super-High Frequency Range in a Semiconductor Diode," was devoted to a description of a parametric amplifier of the centimeter range built by the authors in a germanium diode and the results of its testing.

The paper of Yu. S. Konstantinov describes an autodyne spectroscope with quartz stabilization in the fundamental frequency for measurement of chemical shifts of the nuclear magnetic resonance. The device's resolving power is $\Delta f f \approx 10^{-6}$.

At the section's last session 24 January the nuclear and electronic paramagnetic resonance during ultrasonic excitation of a crystalline grid were examined theoretically in the report of L. L. Myasnikov and Ye. N. Plotnikova, entitled "On the Quantum Magnetic-Acoustic Effect."

The theory of the propagation of electromagnetic shock waves in ferrites was set forth in the report of A. V. Gaponov and G. I. Freydzman. In the report were formulated the conditions of the formation of breaks in electromagnetic waves, and the structure of a shock wave front was also examined in the simplest example (in the case of wave propagation in the direction of the primary magnetization). The possibility of applying this phenomena in super-high frequency technology was noted in the report.

The papers of V. P. Tychinskiy and Yu. T. Derkach gave the elements of the theory of a parametric super-high frequency amplifier and generator in ferrite, and also cited certain findings of experimental investigations of such systems.

I. A. Deryugin's paper, entitled "The Doubling of Frequency in Ferrites," was devoted to the non-linear effect in mixed ferrites. The author investigated experimentally the dependence of the level of the second harmonic of signal value on the fundamental frequency of 9,400 Mc of the external magnetic field and the technique of preparing specimens.

V. M. Vamberskiy made a report, entitled "Variation of Tensor of Magnetic Permeability of Ferrites at High Level of Power."

General Radio Engineering Section

The reports read at the general radio engineering section were devoted to problems of radio measurements, raising the reliability of radio-electronic devices, accomplishing the best amplitude-phase modulation, the problems of getting laminar and three-dimensional X-ray pictures and so forth.

The report of V. A. Koval'chuk on division of frequencies in two-circuit autogenerators aroused great interest among those present. The audience heard with keen attention the paper of V. P. Lyanniy about the investigation of errors of an integrator for achieving optimal amplitude-phase modulation and the correction of errors. In the report were set forth the chief considerations in choice of the parameters of the integrator's line of retardation, the integrator's errors on account of the discreteness of summation and the terminal limits of integration were examined, also the means of correcting errors.

V. P. Kovalev told about determining the modulus and phase of the intensity of an electrical field at super-high frequency by means of simultaneous measurement of transient components of the field. The block diagram of a unit based on the proposed method was shown in the report, characteristics of circuit elements were examined and the findings of experimental measurements discussed.

Interest was aroused also by A. A. Tyutin's report on the elements of a television computer for deriving laminar and also three-dimensional X-ray pictures. The conditions of the roentgeno-technical examination of subjects were so selected that the corresponding integral equation had a single solution. The information about the subject recorded on photographic film during its roentgenoscopy was transformed in the picture by the television computer which performed by instrumental means the appropriate integral transformation. One of the possible circuits of a television computer was described in the report and data given on its main elements.

The findings of work in the investigation of performance characteristics of the screens of electron-beam tubes (visual range characteristics) were set forth in M. M. Gratsianskiy's report. An equation was derived that makes it possible to calculate the visual range characteristics of a signal on the screen of an indicator operating with a brilliance modulator.

The reports of A. G. Kislyakov on the sensitivity of measurers of weak signals with continuous spectrum and I. A. Fastovskiy on a device for analysis of radio noise were devoted to problems of radio measurements. V. A. Malyshev's paper was devoted to a theoretical investigation of autogenerators with a single non-linear element. Questions of relaxation oscillators were expounded in the paper of G. L. Sobolev.

Ye. A. Domanov reported about an investigation of an attenuator based on the effect of changing the concentration of current carriers in a thin semiconductor, situated in a magnetic field, during the flow of an electric current through it.

In the communication of A. A. Bassonov about evaluation of the reliability of radio-electronic devices, the averages were given between the estimated and the experimental values of the reliability magnitude of certain standard unit elements, which can be used in rough appraisal of the reliability of these devices. The method of reserve elements was shown to be approximately five times more effective than the method of duplicating.

General Electronics Section

At three sessions of the general electronics section, 14 reports were read, devoted to the investigation of intensive electron beams, the modelling of fields and electron trajectories; also read were several communications of interest for the design and operation of electric vacuum devices.

P. V. Golubkov and I. G. Kozlov reported about the results of an experimental investigation of the distribution of the velocities of electrons in a ribbon plane-parallel beam of the Pearse gun by the method of the Hughes-Rozhanskiy cylindrical capacitor. The effect of various factors (filament voltage, degree of vacuum, etc.) on distribution of velocities was investigated.

The paper of B. M. Tseytlin examined theoretically the question about the limit current in an electron beam of finite length and varied configuration of cross section with conducting walls around the beam present.

The question of practical interest on the neutralization, by ions, of the space charge of an electron beam in a relatively high vacuum, was treated in V. P. Tarasov's report. Tarasov made an experimental investigation of the action of an ion trap on the passage of current. It was found that the use of ion traps leads to improvement of current passage in parallel beams and reduces the destruction of the cathode by ion bombardment.

I. K. Ovhhinikov and I. S. Zinchenko spoke about the method of measuring parameters of an electron beam by radial distribution of current densities, the potential and axial velocities of electrons by means of an intersecting beam of a vibrating sonde. The report gives theoretical grounds of the method and experimental findings.

Described in the paper of Yu. I. Anisimov and A. I. Vystavkin is a unit for modelling the trajectories of relativist electrons in the shifting field of a magnetic undulator by means of low-volt electron beams. A method is cited for measuring and plotting projections of trajectories according to the position of spots on a sliding screen.

G. M. Gershteyn's paper substantiated a new experimental method of determining the intensity of an electrical field along the line of travel of a small charged body, by means of measuring the induced current. The method is based on the Rameau-Shokley [?] theory. The possibility was examined of applying the method for investigating the fields of certain periodic structures; results of experiments are given. Also read was Polyakov's report: "Investigation of Certain Functional Properties of Arbitrary Electrical Systems with Equivalent Electrodes by means of Models with Rubber Membranes."

S. M. Levitskiy and I. P. Shamshurin reported about the method of measuring the concentration of electrons in gas-discharge plasma by means of a high-frequency sonde which is a single-wire or two-wire line, the pole of which penetrates the plasma. The method gives results that are lower (1.5 to 2 times less as compared to the method of Langmuir's probe); this discrepancy can be qualitatively explained.

The report of K. I. Kononenko and G. A. Sobol set forth the results of an experimental study of the detector properties of gas discharge plasma of varied origin and chemical composition as they depend on a number of factors (pressure, frequency, conditions and so forth.)

The report of V. D. Sobolev and M. N. Uralpova was devoted to the problem of measuring the thermo-electron emission of oxide cathodes in ionic devices. It appeared that horizontal sections corresponding to the cathode emission current are detected in the volt-ampere pulse characteristics of thyratrons at lowered current densities. This permits more precise evaluation of the cathode emission properties, whereas only very rough estimates can be made from characteristics measured at high current densities. The proposed method of measuring thermo-electron emission of an ionic device's oxide cathode is convenient for checking the manufacture of cathodes and investigating their changes in the process of device operation.

G. I. Golub, P. A. Tarasov and L. I. Gubanov described three types of oscillographic tubes they had developed for recording super-high frequency oscillations in the frequency range to 1,000, 5,000 and 10,000 Mc.

The reports of N. V. Rabodzeya, entitled "Thermo-mechanical Processes that Determine the Static and Dynamic Form-Resistance of Electric Vacuum Device Designs," and S. A. Tikhtin, entitled "Electric and Thermal Ratios in Modelling Electric Devices," read in the section were of interest for designing and engineering estimates of various electric vacuum devices.

Also read at the section was A. A. Genio's report, entitled

"Chief Characteristics of Tyratrons with Gold Cathodes and the Prospects of their Application."

Section of Semiconductors and Their Use in Radio Devices

In this section the reports were devoted to analysis of the physical processes in semiconductor devices; the properties of semiconductor materials were examined as well as the analysis of the work of circuits employing semiconductor devices and materials.

An investigation of the electrical and recombination properties of germanium with an admixture of beryllium in a wide temperature interval was reported in the paper of V. Ya. Lashkarev, R. N. Bondarenko, V. N. Dobrovol'skiy, V. G. Litovchenko, G. P. Zubrin and V. I. Strikh. It was demonstrated that beryllium is twice ionized at room temperature by the acceptor impurity capable of strongly alloying the germanium without reducing substantially the life time of the outside carriers.

The paper of V. N. Vertoprakhov was devoted to the problem of the anisotropy of a number of the properties of germanium monocrystals. The author showed that monocrystals manifest a number of anisotropic properties - anisotropy of hardness determined by the method of mutual abrasion, anisotropy of corrosion, anisotropy of the electric discharge routes on the germanium monocrystal surface, anisotropy of variation of resistance in the magnetic field and anisotropy of the cross photomagnetic effect. It is essential to take these phenomena into account when manufacturing devices as well as when using the finished devices.

The findings of experimental investigations of contacts of germanium with a series of metals and alloys were set forth in the report of A. P. Vyatkin.

Experimental dependence of noises on temperature in the low-frequency part of the spectrum was examined for monocrystalline specimens of germanium in the paper of V. V. Potemkin and G. A. Chukina.

On the basis of ideas about bipolar and monopolar recombination, V. A. Malyshev examined the problem about the inertness of semiconductor devices which convert pulses of light or electron irradiation into secondary pulses of current or light emission (Luminescence). The principles derived make it possible, by the kind of frequency characteristic, to determine the recombination character and, by a certain kind of recombination, to select a photoconductor for getting the needed frequency characteristic.

N. S. Spiridonov examined the frequency characteristics of drift semiconductor triodes and analyzed their equivalent circuit. The derived results have importance for calculating the circuits of these triodes.

The phenomenon of "closing" in semiconductor triodes and its several applications were discussed in Ye. K. Vasil'yev's report.

The effect of a germanium plate, having variously processed

surfaces, on the propagation of waves in a waveguide was examined in the paper of N. V. Aleksandrov, L. B. Gorskaya, Ye. M. Gershenzon and V. S. Etkin. The findings of an investigation of amplitude and phase modulation of a passed and reflected wave when electrical and magnetic fields are applied to the plate indicate the possibility of utilizing the given phenomenon in parametric circuits.

In the paper of G. P. Petin a theoretical and experimental examination was made of the determination of threshold voltages of the Schmitt trigger in junction transistors. The dependence of threshold voltages on temperature was determined experimentally and means of temperature stabilization indicated. The conditions for deriving hysteresis loops closest to rectangular were also determined.

Ye. F. Doronkin made a report on the theme: "Design of Temperature Compensation Circuits of Semiconductor Relaxation Oscillators."

V. V. Voskresenskiy made an analysis of phantastron type semiconductor oscillators of linearly variable voltage.

The excitation mechanism of a generator in a point-contact semiconductor triode was examined in the report of Yakunkin. The analysis method, proposed by Yakunkin, however aroused serious objections from a number of conference participants.

Also read at the section were the reports of I. N. Magulin, entitled "Investigation of Certain Semiconductor Amplifier Circuits," of P. V. Besspalov, entitled "Investigation of Certain Methods of Frequency Stabilization in Semiconductor Generators," S. I. Malashenko, entitled "Means of Raising the Stability of Direct Current Amplification in Semiconductor Triodes," and G. I. Oliferenko, "Semiconductor Triodes in a Line Scanning Generator."

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